To propose a novel technique for the better analysis of Ice Properties using GABOR Filtering

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Abstract - SAR algorithm has been utilized to detect the sea ice to spare the ship from any sort of damage. So ship does not strike with ice. SAR algorithm is connected on RADAR1 imagery data to get accurate results. Pixel based segmentation MIRGS algorithm to segment the ice has been studied. Because of this we can differentiate the ice based on its properties. PMA detector has likewise been studied and in this way can easily detect and recognize target by knowing the signal values. There are numerous methods for multi temporal segmentation from the MODIS data called TempoSeg strategy for multiyear sea ice floes has likewise been studied. RADARSAT1 imagery data is utilized by Synthetic Aperture Radar to detect the ice of sea at different regions of the seas. Automated algorithm gives better consequence of target utilizing R1 imagery data. In task work, we need to execute the automated SAR algorithm to detect sea ice which is as of now implemented. In further work we need to enhance this automated SAR algorithm to get more accurate results utilizing RADARSAT1 imagery data and will attempt to utilize the RADARSAT2 imagery data to make it compatible to SAR algorithm.

Keywords - Sea Ice, SAR, Floe, Raster Scan, Dual Polarization, Gabor Filtering

I. INTRODUCTION

Image processing is a process in which an image is translate into digital form and applied some operations so that information can be extracted from it. In this entire process input can be any image, video frame and output can be like features of images and any other things associated with it. Most of the time this process is known as digital image process but sometimes digital and optical image processing is also considered [1].

1.1 Image Segmentation: Image segmentation can be characterized as the instrument of subdividing a digital image into multiple pixels or regions. Regions ought to greatly uncover to interpret objects. A region is gathering of similar pixels. The aim of segmentation is to speak to the image into some meaningful structure. There are wide ranges of ways to perform segmentation. Thresholding, color based segmentation, watershed segmentation, and texture methods and so forth are few of them. Image segmentation alludes to the way toward partitioning a digital image into N number of parts. The images are segmented on the basis of set of pixels or pixels in a region that are similar on the basis of some homogeneity criteria, for example, color, intensity or texture, which locates and identify objects or boundaries in an image [2]. Image segmentation partitioning a digital image f(a, b) into disconnected, continuous, and nonempty subsets. After that from these subsets we extract the information of high level. Practical applications of image segmentation include object identification and recognition, criminal examination, restorative image processing, facial recognition, satellite images, quality assurance in factories, and so on. The two Image Segmentation areas of consideration are:

1. Region based Segmentation

2. Edge based Segmentation

1.1.1 Region based segmentation: Region based segmentation can be defined as partitioning the image into regions. Region is an important concept to depict the image because regions may correspond to objects in the scene. In this, formations of pixels around some objects are located creating a region of those pixels and separating the region from the rest of the image [3].

1.1.2 Edge based segmentation: Edge segmentation can be defined as that in which each object is surrounded by a border. Edge detection is used to identify the edges and edge pixels. The border of the object is closed, visible and can be detected in the intensity values of the image. It analyzes the distribution according to gray level value scale [3].

II. PREVIOUS WORK

Xuezhi Yang et.al [4] proposed in paper another approach to sea ice segmentation in synthetic aperture radar (SAR) intensity images by combining an edge-preserving region (EPR)-based representation with region-level MRF models has been talked about. To construct the EPR-based representation of a SAR image, edge strength is measured utilizing instantaneous coefficient of variation (ICOV) whereupon the watershed algorithm is connected to partition the image into primitive regions. The proposed segmentation technique has been evaluated utilizing a synthetic sea ice image corrupted with varying levels of speckle noise and also real SAR sea ice images. Relative to the existing region-level MRF-based methods, testing results have demonstrated that our proposed technique considerably improves the segmentation accuracy at high speckle noise and achieves all things considered 29% reduction of computational time. Mari-Ann et.al [5] proposed in this paper they explored an automatic segmentation of synthetic aperture radar (SAR) satellite images of sea ice. The investigation is based on a comparison of an automatically segmented SAR image and manual classifications by ice service analysts. The automatic algorithm utilizes statistical properties of the backscattered radar signals to segment the SAR image into a given number of classes. The number of classes is determined from accessible ground truth. Sea ice specialists, aided by different in-situ data, could label the vast majority of the segments from the automatic algorithm. They utilized the physical information in the polar metric features utilized as a part of the classification algorithm, keeping in mind the end goal to further explore the class labeling. Bernd Scheuchl et.al [6] proposed in this paper a CFAR method is proposed for the detection of ship in presence of high resolution of SAR amplitude of dual polarization. In order to get better form of clutter ratio, a PMA detector has been designed, thereby preventing any form of biasness for the ship due to SCR as it's quite sensitive to clutter ratio and the procedure thus helps to reduce the discrimination to a huge extent. Statistical model of PMA detector has also been described using G0 distribution. This distribution is suitable for coping with the complex backgrounds of sea. Ramsay et.al [7] proposed in paper a design of a TempoSeg method for multi temporal segmentation of sea ice to detecting the melting rate of multilayered sea ice. MODIS images has been generated for the experimentation purposes, position of ice floes has been detected using microwave radiometer to determine the position of ice floes with time and changing atmosphere. The procedure involves dividing the image into Floe and the background. Feature extraction is done at the first place to extract the useful features followed by marking of floes and shape constrained region growing is applied to detect to best shape. Region maps are generated by post filtering and area of interest or ice floes is thus obtained using morphological operators on piece of MODIS images. The advantage of this newly proposed approach is the availability of the area of the image under study for the region of interest over the period of time. Scheuchl et.al [8] proposed in this paper a study about the study of various feature extraction methods and is marked as an important research area in order to implement the intelligent processing in more précised and effective manner. The best texture extraction method has been determined based on the geostatistic principles and entropy concept. These are the two evaluating factors. The proposed method is marked superior over the other pre existing approaches. Experiments has been performed on medical data which is complex in nature due to the presence of discontinuities when it comes to X-rays or magnetic resonance imaging and the piece of data is hard to segment and analyze.

In the previous work the techniques for sea ice segmentation. The techniques involved various methods which helped in studying the images received. The watershed algorithm, the usage of radar signals, and the CFAR methods have been used which have provided their own advantages at some level. Other methods involved feature extraction and texture extraction procedures. All the techniques have been used according to their advantages and disadvantages.

III. DUAL POLARIZATION

RADARSAT 2 is a multichannel receiver. The HH channel of it provides same data as of R1. HV channel of R2 is a new addition and is anticipated to enhance the bias of ice and water. Unusually, water is wind roughens and it looks similar to ice at several incidence angles in the channel. Therefore, it is required for it to enhance the sea ice image segmentation results using automated algorithms of SAR [9]. RADARSAT 2 provides all the features of RADAR1 and offers some additional features to distinguish different ice types. Dual polarization is the advanced feature provided by R2 for sea ice mapping is selective dual polarization scan SAR wide mode. It incorporates the same swath width of 500 km as of Radar1 in single polarization. Dual polarization provides Scan SAR mode with additive data information [10]. The ENVIST Advance SAR (ASAR) also provides the features of dual polarization of bits, it is having different swath width of 100 km from R1 and R2. ASAR has five modes and five different preferences of polarization levels which can take different images of earth's surface. We are having a full SAR scene which contains pixel resolution of 1000*1000 m. Now, we will target on SAR Scan wide mode to understand the use of R2 dual polarization and will use this model for sea ice monitoring [11].

3.1 PMA Detector: In SAR, reflected rays come from target to make it visualize. Point of target will not get if the intensity or amplitude of reflected rays will not large, usually, because of low signal to clutter ratio. Fundamentally, SCR affects the detection in the presence of amplitude or intensity data. Thus, a good detector should be designed in such a way that SCR should be improved naturally. Due to this, target can be enhanced and disorder constrained. We know that, the processor which is mostly used in SPAN detector and this makes only use of image intensities because the sum of all polar metric channels is incoherent [12]. SPAN detector is having the synthetic power of all the channels. Therefore, according to some analysis, it has been noticed that this detector can retrieve a higher SCR and lower noise level than HH, HV, or VV independently. So, we can conclude that SCR can be improved with the way of synthetic power. Due to this, by using single channel will full information; we can single out the targets from the disorder or clutter. For the moment, it is very hard to give the appropriate detection with the SPAN detector because of the lack of knowledge of related data. Considering these facts, a PMA detector has constructed as another synthetic power.

IV. PROPOSED METHODOLOGY

SAR generated data is employed for mapping the ice. Among the various segmentation methods for interpretation of such data, unsupervised approach is used. The data in the form of images is obtained from RADARSAT 1 at the first place. But it does not provide accurate results. Thus development of various automated algorithms reduced this hurdle to some extent but further enhancement in such techniques is further required together with the source and RADARSAT 2 provided better outcomes in terms of considering factors such as density and position. The given work is focused on analyzing the pixel data and the related algorithms. Study of region based algorithms and its use will also lead to achieve the desired output and results are needed to enhance SAR for RADAR1 imagery data. Now, RADARSAT 1 provides better results using the concept of polarization in SAR and we can get more accurate results by enhancing it.

Split and Merge Segmentation: Splitting and merging endeavors to divide an image into uniform regions. It is based on the idea of divide and conquer to segment homogeneous regions of interest. The SM algorithm firstly splits the articles based on the threshold used for homogeneity and then merges the splitted regions those are identical regarding some predefined threshold used for homogeneity to form final segmented regions. Both the splitting and merging are done based on the physically specified thresholds.

Gabor Filter: The 2D Gabor filter is a type of band-pass filter that has directional and frequency selectivity and achieves the best combination of the spatial and frequency domains. Gabor filter frequency and orientation representations are similar to those of human visual system, for texture representation and discrimination it has been found to be remarkably appropriate. Therefore, the 2D Gabor filter is often utilized to extract texture features.

$$g(x, y, \theta, \phi) = \exp\left(-\frac{x^2 + y^2}{\sigma^2}\right)\exp(2\pi\theta i(x\cos\phi + y\sin\phi))$$

It has been shown that σ, the standard deviation of the Gaussian kernel depends upon the spatial frequency to be measured, i.e. θ. In our case, σ = 0.65θ. θ is the orientation of the Gabor filter. σ represents the space constants of the Gaussian envelope along the coordinate axes x and y. These parameters determine the bandwidth of the band-pass filter.

Raster Scan: In a raster-scan system, the electron beam is cleared over the screen, one row at a time from top to bottom. As the electron beam moves over every row, the beam intensity is turned on and off to make an example of illuminated spots. Picture definition is put away in memory area called the invigorate buffer or frame buffer. This memory area holds the arrangement of intensity values for all the screen points. Put away intensity values are then recovered from the revive buffer and "painted" on the screen one row (scan line) at a time. Every screen point is alluded to as a pixel. Toward the end of every scan line, the electron beam comes back to the left half of the screen to begin displaying the following scan line. The arrival to the left of the screen, subsequent to refreshing every scan line, is known as the horizontal retrace of the electron beam. Also, toward the end of every frame the electron beams returns (vertical retrace) to the top left corner of the screen to begin the respective frame.

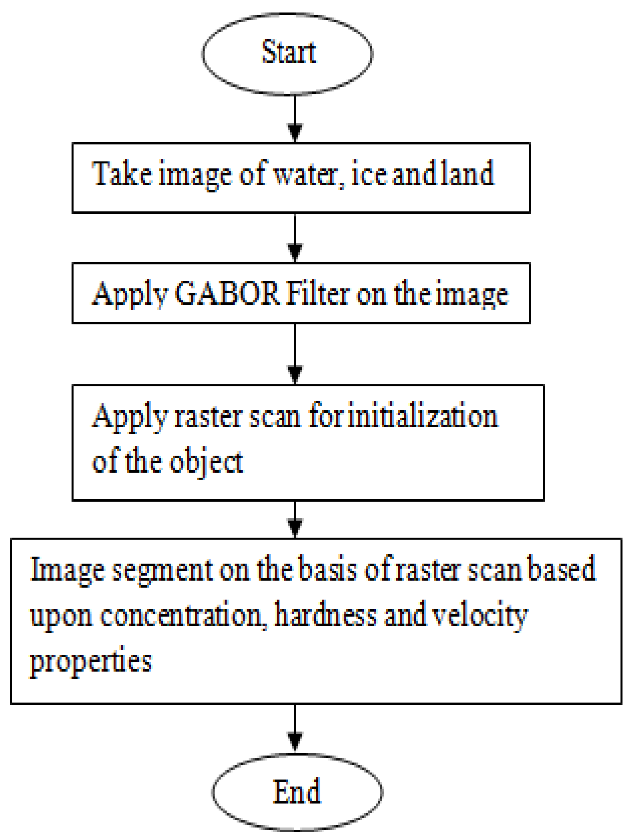


Fig 4.1 Flowchart of Methodology

The existing algorithms SAR is compatible to RADARSAT1 and give accurate results to detect the ice and for more accurate and efficient results of ice images we need to enhance the SAR algorithm. So, we need to enhance the automated algorithms to capture better results. In proposed work we have used raster scan and gabor filtering to get better and accurate results.

Improved Morphological Algo

INPUT :- INPUT IMAGE FOR SEA ICE DETECTION

OUTPUT :- VALUE OF IT,IC AND IV

Start ();

1. Input image and store in variable a;
2. [b c]=size(a);
3. Define initialize starting pixel and increment value of the pixels
4. If property of p(i,j)!=p(i+1,j+1)
5. Image will be segmented
6. else
7. Store value of IT, IV and IC
   STOP()

V. EXPERIMENTAL RESULTS

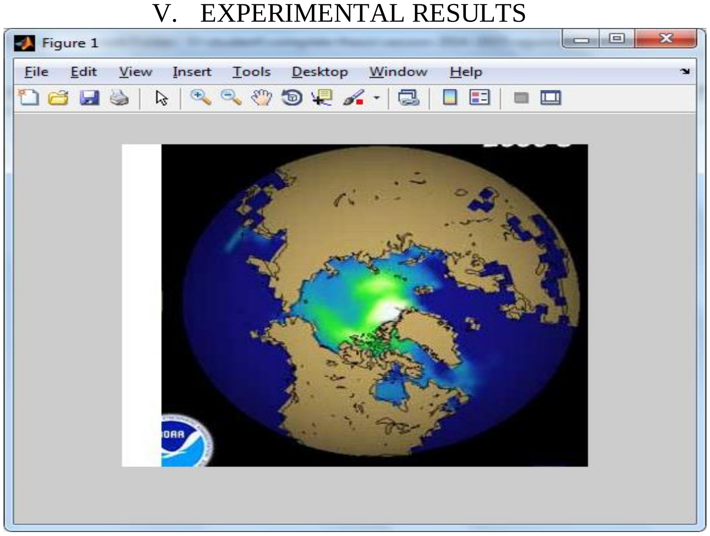


Fig 5.1: Input Image

As shown in figure 5.1, the image is input which contains ice, water. In this image technique of morphological segmentation is connected to extract the image properties like ice thickness, ice speed and ice concentration.

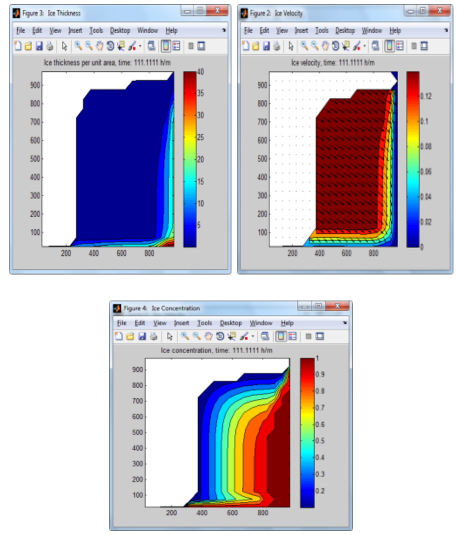


Fig: 5.2 a) Ice Thickness b) Ice Velocity c) Ice Concentration

In fig 5.2 the image is input which contains ice , water. In this image technique of morphological segmentation is applied to extract the image properties like ice thickness, ice velocity and ice concentration.

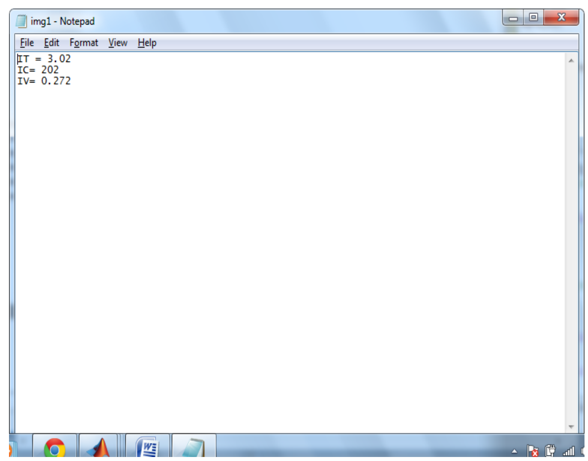


Fig5.3: Values in Text File

As appeared in figure 5.3, the image is input which contains ice, water. In this image technique of morphological segmentation is connected to extract the image properties like ice thickness, ice speed and ice concentration. The last values of ice concentration, ice speed and ice thickness is defined and analyzed value is appeared in content file.

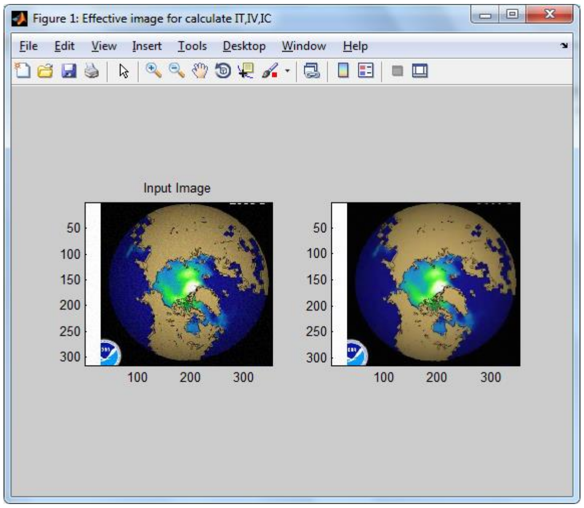
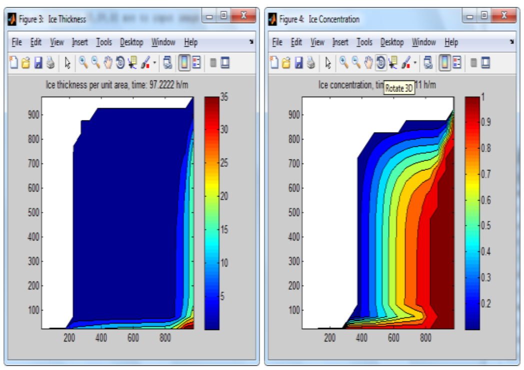
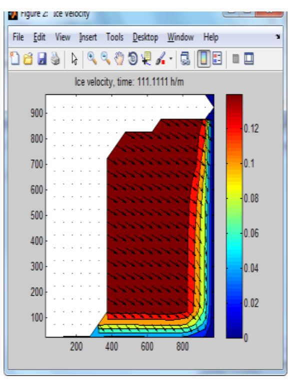


Fig 5.4: Input Image



(a) (b)



(c)

Fig. 5.5 a) Ice Thickness b) Ice Concentration c) Ice Velocity

In this figure 5.5 the image is input which contains ice, water. In this image technique of morphological segmentation is connected to extract the image properties like ice thickness, ice speed and ice concentration.

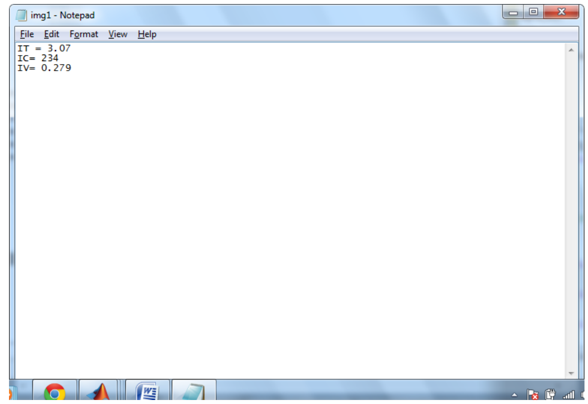


Fig. 5.6 Final Values

As shown in figure 5.6, the image is input which contains ice, water. In this image technique of morphological segmentation is connected to extract the image properties like ice thickness, ice speed and ice concentration. The final values of ice concentration, ice velocity and ice thickness is defined and analyzed value is shown in text file.

Analysis of Work

Parameter	Existing Algo	Proposed Algo
Ice Thickness	1.01	1.07
Ice Concentration	2.28	2.34
Ice Velocity	0.1890	0.270

Table 1: Table of Comparison

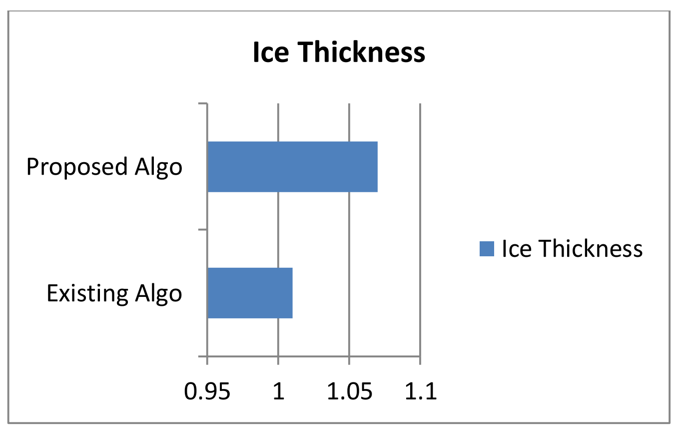


Fig 5.7 : Ice Thickness

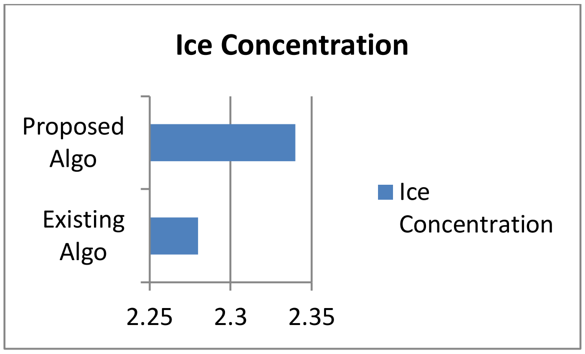


Fig 5.8: Ice Concentration

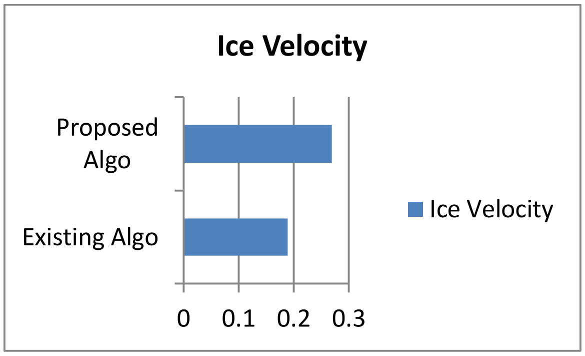


Fig.5.9 : Ice Velocity

VI. CONCLUSION

The image segmentation is the technique in which the images are segmented for better analysis of the given piece of data. In proposed work along with the segmentation of images of ice present in sea we are working on ice sea segmentation. SAR is the algorithm being utilized for analyzing the properties of the ice sea images. Principle center is on getting the ice properties with a specific end goal to do the further analysis and segmentation in an enhanced way. Ice thickness, ice concentration and ice speed are the imperative parameters being focused on to segment various ice types too. In this paper, an enhancement is being proposed in the SAR algorithm to improve analysis of ice images and the ice types. In future technique is applied for classification utilizing nearest neighbor classifiers.

VII. REFERENCES

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